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The Effect of Involuntary Maternal Job Loss on Children's Behaviour and Non-cognitive Skills [☆]

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Abstract

This paper uses propensity score methods to analyse the effect of involuntary maternal job loss on children's non-cognitive skills. My analyses are based on a rich and nationwide random sample, the German Socio-Economic Panel Study (SOEP) that includes information about maternal job loss and child behaviour and non-cognitive skills, in addition to a rich conditioning set. The results show that maternal job loss increases preschool children's socio-behavioural problems and decreases adolescents' belief in self-determination.

Keywords: Child development, Maternal Job Loss, Non-cognitive Skills, Propensity Score
Methods

JEL: J13, J63, J65

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1. Introduction

Job loss not only leads to a considerable fall in income, it also affects the health and well-being of individuals; possibly even leading to divorce (see for example the studies by Charles and Stephens, 2004; Eliason and Storrie, 2009; Marcus, 2014; Rege et al., 2009). Studies also show that it has spillover effects on partners (Marcus, 2013) and children (Huff-Stevens and Schaller, 2011; Kalil and Ziol-Guest, 2005, 2008; Lindo, 2011; Oreopoulos et al., 2008; Rege et al., 2011). This paper contributes to the literature on spillover effects of job loss by analysing the impact of involuntary maternal job loss on children's behaviour and non-cognitive skills. The paper also contributes to our understanding of factors that impact children's development of behaviour and non-cognitive skills (Cunha and Heckman, 2007; Cunha et al., 2006, 2010).

This paper focuses on non-cognitive skills during preschool ages and during adolescence, as an increasing number of economic studies suggest that non-cognitive skills are important predictors of later educational achievements, health outcomes, and labour market success (Blanden et al., 2007; Carneiro et al., 2007; Cobb-Clark and Schurer, 2013; Currie and Stabile, 2006; Heckman et al., 2013; Prevoo and ter Weel, 2015). Studies show that non-cognitive skills impact cognitive skills, but not vice versa, and that these non-cognitive skills are as important as cognitive skills regarding school performance (Cunha and Heckman, 2007; Heckman et al., 2006). However, less is known about how non-cognitive skills develop if a negative shock occurs to the family environment. Yet, this is particularly relevant, since the family is likely even more important than schools or other institutions for the development of skills (Carneiro and Heckman, 2003). The few existing studies on parental job loss and child outcomes look at children's academic performance, likelihood of grade repetition, and health, or consider earnings for adult children (Huff-Stevens and Schaller, 2011; Kalil and Ziol-Guest, 2005, 2008; Lindo, 2011; Oreopoulos et al., 2008; Rege et al., 2011).

It is plausible that effects of maternal job loss vary with child age and my analyses therefore exploit both a preschool (child age 5/6) and an adolescence/early adulthood (age 17) sample. The preschool sample allows for analyses of child behaviour as measured by the socio-emotional behaviour based on a modified version of the Strength and Difficulties Questionnaire (SDQ) developed by Goodman (1997), which assesses children's socio-emotional regulation. The adolescence sample, on the other hand, includes information about Locus of Control, which is based on a concept developed by Rotter (1966) and describes to what extent a person believes in self determination or fate. Both ages mark important phases: Age five/six marks the transition to school in Germany while age seventeen is that time at which students make decisions about further education.

It is *ex ante* unclear how maternal job loss affects the well-being of the children of the household. There may be negative as well as positive effects; parental stress caused by the job loss may transmit to the children just as an income loss could lead to deterioration of the family environment. Involuntary maternal job loss may increase the amount of time the mother spends

with her children and depending on the quality of that interaction, this may lead to both worse or improved child outcomes.

My analyses consider the effects of job loss stemming from plant closures and dismissals. My main analyses combine these two types of job loss into one measure of job loss but robustness analyses acknowledge that their impact on families may vary. Results are based on propensity score matching while drawing on a rich data set informative about the characteristics of families in which women experience job loss and child outcomes. The data used come from the German Socio-Economic Panel Study (SOEP). The SOEP contains a particularly rich set of variables on non-cognitive skills, as well as an extensive set of variables regarding household, parental and child characteristics that is well suited for propensity score methods and its requirement of selection on observables. In addition, with SOEP data, specific mechanisms behind the effect of maternal job loss on children's behaviour and non-cognitive skills can be examined. The SOEP data comprise information on life satisfaction and household income, as well as on personality traits, which facilitates examining possible mediators of the effect of maternal job loss on children's skills.

This study shows that involuntary maternal job loss negatively affects the non-cognitive skills of children. A mother's involuntary job loss increases a preschool child's socio-emotional problems by 51% of a standard deviation and decreases adolescents' internal locus of control by 26% of a standard deviation. The results also show that job loss decreases the life satisfaction of mothers with preschool children and significantly affects the household income in the adolescence sample. Estimating the effect of maternal job loss on child outcomes including these potential channels decreases the size and the significance of the effect on preschool children's socio-emotional behaviour but not on adolescents' internal locus of control.

The remainder of the paper is structured as follows: Section 2 discusses the related literature and theoretical links of maternal job loss and children's non-cognitive skills. Section 3 outlines the empirical strategy and in Section 4 the data set is described. In Section 5 the estimation results are discussed. Section 6 presents some robustness tests before Section 7 concludes.

2. Linking maternal job loss and children's non-cognitive skills

As discussed above, the direction of the effects of maternal job loss on child behaviour and non-cognitive skills is not obvious. The skill formation framework proposed by Cunha and Heckman (2007) suggests that children's skills are produced with parental inputs of time and goods. There are likely dynamic complementarities in skills, i.e. skills acquired in one period depend on those of previous periods, which again are dependent on home and school inputs as well as parental ability (Todd and Wolpin, 2007). Throughout the skill formation process, timing is an important aspect, as inputs impact human capital production differently across childhood stages. In such a framework, a household with a working mother would have less time available to distribute between child and employment than would a household with a non-working mother.

Mothers who work full-time or part-time compared to mothers who do not work have different possibilities to divide their time. This production function may, thus, be affected by maternal job loss, as such a disruption in the household could be the source of stress, which may impede child development. The following potential channels of maternal job loss are discussed in this paper: A change in life satisfaction, household income, personality traits, and quality of time.

The literature concerned with the relationship between life satisfaction and unemployment (see for example the work by Clark et al. (2010) or Knabe et al. (2010)) finds that job loss (as well as the unemployment level in general) is likely to decrease life satisfaction. This may, in turn, deteriorate the relationship between the mother and her child.

An income loss after job loss might be another potential source of instability at home. Tension due to decreased financial resources between parents could spread to their children, leading to an unstable temper of children affecting their relationship with their peers. In addition, maternal job loss also reduces future family income and might impact on children's development through a reduction in financial resources (e.g. Baum, 2003; Rege et al., 2011). But, because German mothers are often second earners, their job loss might impact the financial situation of the household less than if the father had lost his job. Further, maternal income loss can often be compensated with her partner's income, assuming dual income; if a single parent loses her job, the effect will be much greater. In addition to their partners' income, individuals receive generous unemployment benefits in Germany when compared to the US, but not to Scandinavian countries. For example, an unemployed person who has a child receives 67% of their previous income as unemployment insurance (UI).¹ Furthermore, they are entitled to tax-financed unemployment assistance after UI payments expire or if they fall below a certain threshold. Thus, an income loss as potential mediator of maternal job loss might be less likely. It is argued that mothers who lose their job may be stressed for reasons other than income reduction.

Job loss might also lead to direct changes in children's non-cognitive skills, as it changes maternal characteristics measured by personality traits such as neuroticism (or emotional stability if coded reversely) and internal locus of control. A mother may, for example, regard job loss as something that has happened to her due to others. Thus, adolescents could believe that fate or actions of others influence success in life.

Furthermore, job loss may also change maternal time and its allocation towards children's non-cognitive skills. A change in maternal time might mediate a positive effect of mothers' displacement, as mothers might spend more time with their children promoting development. For example, a Norwegian study by Rege et al. (2011) finds an insignificant but positive effect of mothers' displacement due to plant closure on children's grade point average at sixteen years of age (3% of a standard deviation). Thus, mothers spending increased time with their children

¹Length of payment depends on the duration of their own contribution to UI (e.g. Caliendo et al., 2013).

seems to have a small but positive effect. Additionally increased maternal time combined with income loss might reduce a child’s time spent in day care. Yet, in Germany day care is not costly (fees are based on income) and therefore it is less likely that children will drop out of day care after maternal job loss.² Thus, children remain in contact with peers from outside the family, which may help in their development.³

3. Empirical strategy

The goal of this paper is to identify an impact of involuntary maternal job loss on children’s non-cognitive skills.

Equation 1 summarizes the linear relationship of maternal job loss (treatment) on children’s non-cognitive skills in the preschool sample if $S_i = SEB_i$ and in the adolescence sample if $S_i = LOC_i$.⁴ S_i comprises non-cognitive outcome of child i , $JOBL_i$ is a variable capturing involuntary job loss, X_i is the vector of conditioning variables and v_i is an error term.

$$S_i = \alpha_i + \beta_i JOBL_i + \gamma_i X_i + v_i \tag{1}$$

The treatment variable is defined as a binary measure that equals 1 if a mother experiences an involuntary job loss and 0 if the mother does not. I classify involuntary job loss as plant closure or dismissal by employer. Since the study looks only at involuntary job loss, other types of job loss are not considered and treated mothers are compared to mothers who do not experience job loss during the observation period. Focusing on plant closure and dismissal by employer ensures that job ends of mothers are independent of any change in children’s development before job loss.

An effect of maternal job loss on child outcome is identified by using ordinary least squares (OLS) if the “selection on observables” assumption is satisfied (see Heckman, 1979). This means that all variables related to both job loss and children’s non-cognitive skills have to be included in the estimations. Furthermore, for OLS to render consistent estimates the relationship between maternal job loss and children’s non-cognitive skills must be linear, an assumption that cannot be clearly verified. This paper, therefore, uses propensity score methods in addition to OLS to estimate the effect of involuntary maternal job loss on children’s non-cognitive outcomes (β_i). Propensity score matching deals with the missing counterfactual problem, as it finds a nearly identical “twin” of each child whose mother experiences a job loss using one or more children whose mothers do not.

²Around 98% of children between ages three and six attend day care (Statistisches Bundesamt, 2014).

³Empirical studies find neutral or positive effects of day care attendance on children’s cognitive and non-cognitive skills, especially for children from disadvantaged families (e.g. Apps et al., 2013; Datta Gupta and Simonsen, 2010, 2012; Felfe and Lalive, 2013; Goodman and Sianesi, 2005; Loeb et al., 2007).

⁴Where SEB is the abbreviation for children’s socio-emotional behaviour and LOC for adolescents’ internal locus of control.

The treatment and control group are matched based on the estimated propensity score ($P(X)$). Before identifying the average treatment effect on the treated (ATT), all observations that do not comply with the common support condition are discarded from the sample.⁵ Hence the sample used for examining involuntary maternal job loss consists only of those treated mothers who have a matched untreated mother based on the same characteristics set X . This paper uses kernel matching to match treatment and control group observations.⁶ Moreover, this paper utilizes a regression-adjusted matching approach as the preferred model specification, which requires controlling for all conditioning variables in the post-matching estimations (see Stuart, 2010). The regression-adjustment method avoids further potential bias if matching is not exact.

Equation 2 shows the estimation of the ATT using a regression-adjusted matching approach, where a matching-specific weight $W_{k,l}$ obtained from kernel matching, is used in the analysis.

$$ATT = \sum_{k \in T} W_k \left[(Y_{1k} - x_k \hat{\beta}) - \sum_{l \in C} W_{k,l} (Y_{0l} - x_l \hat{\beta}) \right] \quad (2)$$

In Equation 2, the symbols T and C stand for treatment group and control group respectively. $W_{k,l}$ represents a matching-specific weight that is the weight placed on individual l to be comparable to individual k .⁷ The weight $W_{k,l}$ includes values obtained from kernel matching for the control group of each treated k :

$$W_{k,l} = \frac{G\left(\frac{P_k - P_l}{b_n}\right)}{\sum_{h \in C} G\left(\frac{P_k - P_l}{b_n}\right)} \quad (3)$$

where $G(\cdot)$ is a kernel function, e.g. Gaussian or Epanechnikov, and b_n is a bandwidth parameter.⁸

Since propensity score methods require that selection is based on *observable* characteristics, unobservables are not addressed. This paper assumes that in the absence of maternal job loss the non-cognitive skills of the treated children and the matched control children would be the same. If this assumption is violated, meaning that treated children differ systematically from children of the control group in terms of unobservable characteristics, the model suffers from endogeneity. For example, children's non-cognitive skills are likely to be correlated with maternal non-cognitive skills, which, in turn, may be affected by an involuntary job loss. Therefore, this paper first examines whether maternal personality traits are correlated with maternal job loss

⁵Figure A.1 and A.2 in the appendix show histograms of the propensity score by treatment status in the preschool and adolescence sample respectively and depict the obtained overlap of treatment and control groups.

⁶Matching is implemented in Stata 11 using the program *psmatch2* provided by Leuven and Sianesi (2003).

⁷ W_k equals one in this estimation of the ATT.

⁸Kernel matching is implemented with an Epanechnikov kernel function and a bandwidth parameter of 0.06 in this paper.

and secondly adds these traits as control variables to the preferred model to address “selection on unobservables”.

4. Data

Using data from the German Socio-Economic Panel Study (SOEP), the analysis is based on a nationwide random sample and a very rich data set. The SOEP started in 1984 and is an annual household panel⁹ that incorporates a series of mother-child questionnaires as well as a youth-specific questionnaire. Both the child-specific modules and the youth-specific module contain detailed information on children, i.e., non-cognitive skills, birth weight, child care usage, school attendance, and grade repetition among others. In addition, the SOEP has rich information on individual characteristics of the children’s mothers as well as on family characteristics. The SOEP accumulates information on current household compositions as well as on past formations. Based on this vast data set, the probability of involuntary maternal job loss is estimated.

4.1. Sample

Since the SOEP includes excellent measures on non-cognitive skill formation for different childhood stages, this paper uses two samples of children - preschoolers and adolescents - to examine the underlying question of this paper. At both stages – either at age five/six or at age 17 – German children face imminent and important transitions: Preschool children start with primary school and adolescents decide upon further education.

The preschool sample consists of children aged five/six in the SOEP whose mothers answered the mother-child questionnaire and were 20 years or older when giving birth. I restrict maternal age at birth to twenty years or older, because in Germany a person attains full age at eighteen years of age and apprenticeships as well as the university school track end on average around age twenty, and thus mark a potential labour market entry. Children have to have non-missing information¹⁰ on the measured non-cognitive skill and their mothers participated in the survey prior to 2003, with no missing information prior to childbirth. For the implementation of the propensity score methods, a point in time at which mother’s are observed to lose their jobs is determined. Since mothers are entitled to three years of parental leave in Germany, maternal working status is assessed after a child’s third birthday. In period $t > 3$ when children are three years or older, it is observed whether mothers are working and thus may lose their job. A detailed discussion of variables used for modelling the selection decision into treatment is given in Section 4.4..

⁹A general overview of the SOEP is given by Wagner et al. (2007), with Schupp et al. (2008) and Siedler et al. (2009) describing the mother-child questionnaires used in this paper. Frick and Lohmann (2010) document the youth questionnaire.

¹⁰For preschool children, 1% of the initial sample has missing information on items measuring socio-emotional behaviour.

The second sample examined in this study depends on the youth sample of the SOEP, which comprises information of children aged 17 at the time of the survey. This adolescence sample is restricted to children born between 1984 and 1993, living with their parents, and having no missing non-cognitive skill information.¹¹ Moreover adolescents are included in the adolescence sample if their mothers were 20 years or older at childbirth, and have reported their employment status during early childhood. Unlike in the preschool sample, maternal employment patterns prior childbirth cannot be observed for all birth cohorts, since the household panel only started in 1984; and because many households entered the SOEP in 2000. For these children nearly no information prior to 2000 is included in the SOEP. Thus, I choose another cut-off date as in the preschool sample to predict mothers' propensity of job loss. In the adolescence sample I use age ten as the cut-off point from which mothers are observed to lose their jobs. I do this for three reasons: first, mothers of these birth cohorts were more likely to return to work while children were in secondary school: In 2008, for example, 59% of mothers with children below the age of six were employed compared to 70% of mothers with children age ten or older (Rübennach, 2010). Second, some mothers earlier working information coincides with the German reunification and its transition years of economic and constitutional merger in 1990/91. A third reason for diverting from the cut-off date used for preschool children is related to children's school careers in Germany. From age ten onward most children move from primary to secondary school.¹² If an earlier cut-off date were used, it would result in an even longer time span during which involuntary job loss would occur leading to spurious results from other events. In sum, in period $t > 10$ when children are ten years of age or older, maternal job loss is observed.

In order to compare the relationship of maternal job loss and all outcome measures utilized in this paper, I further restrict both samples to observations that have non-missing information for all maternal outcomes.¹³

4.2. Treatment and control group

The treatment and control groups consist of mothers who are working at age three of their child in the preschool school sample and at age ten for the adolescence sample. As described above, this study includes children with valid non-cognitive skill information and whose mothers participated in the survey pre- and post-treatment.

¹¹Very few observations (2.3% of the initial sample) are dropped due to missing information on items of the locus of control measure.

¹²In three federal states (Berlin, Brandenburg, and Mecklenburg-Western Pomerania) children transit from primary to secondary school following the completion of grade six, i.e. from age twelve onward. Thus, I also address age twelve as cut-off date in a robustness check in Section 6. The result remains similar to the estimate obtained with the cut-off at age ten.

¹³The final sample size comprises 229 observations in the preschool sample and 522 observations in the adolescence sample.

The treatment group comprises children whose mothers experience an involuntary job loss: in the preschool sample mothers job loss is observed between age three and age six of the child; and in the adolescence sample between ten and seventeen years of age. An involuntary job loss is identified by looking at job ends that are plausibly exogenous. In the SOEP data, a job loss is experienced by mothers within a survey year and is reported since the last interview. Mothers can choose among eight categories for job ends, including plant closure, dismissal by employer, resignation, retirement, suspension, or end of temporary contract. Since displacement by plant closure occurs less frequent in the data used, this study considers plant closure and dismissals as involuntary job ends. Combining lay-offs and plant closures into one category is a common approach in the literature¹⁴ on job loss, as looking only at plant closure is statistically challenging because the number of displacements is substantially lower; a fact that also applies to this paper. In addition, studies by Marcus (2013, 2014) show that, by using the same German data as this paper, results including dismissal by employer do not differ from those using only plant closure as reason for job loss. Still, I investigate the robustness of my results with respect to combining the two types of job loss.

While plant closure is arguably less likely endogenous in the context of child outcomes, dismissals may be caused by maternal behaviour associated with child outcomes. However, it is unlikely that specific maternal behaviour, such as lack of concentration or absence due to sickness of children, will lead to a dismissal due to German dismissal protection laws. A comparison of OECD countries regarding strictness of employment protection against individual dismissal shows that Germany is among the countries that “are far stricter than the average country” (see OECD, 2013, p. 83). Therefore, it is argued in this paper that dismissal by employer may be viewed as involuntary, since due to the Protection Against Dismissal Act individual dismissals are likely for operational, i.e. for business operation reasons, than for behavioural reasons. Yet, the estimations in this paper include child-related characteristics and maternal well-being indicators as covariates in order to ensure that the definition of job loss used is unaffected by maternal behaviour.

In the preschool sample, 6% of working mothers lose their job involuntarily in the observation period, whereas in the adolescence sample 12% of mothers experience an involuntary job loss. Plant closures are experienced by 2% of mothers of preschool children and by 5% of mothers of adolescents. The difference in percentages can be attributed to a variation in length of the observed time periods, since young children’s mothers are only observed within a three year period, whereas adolescents’ mothers are observed over a seven year time frame.

The control group consists of children whose mothers do not experience an involuntary job loss during the observation periods. Similar to the treatment group, control group children must have valid non-cognitive skill information and their mothers must have participated in the survey

¹⁴See among others the studies by Coelli (2011); Huff-Stevens and Schaller (2011); Kalil and Ziol-Guest (2008); Schaller and Zerpa (2015).

pre- and post-treatment, i.e. prior to age three and at age five/six for the preschool sample and prior to age ten and at age seventeen in the adolescence sample.

4.3. Outcome variables

In the SOEP non-cognitive skills are measured at different childhood stages using different scales. Non-cognitive outcomes often include behavioural, social and emotional skills. This is true for the outcomes used in this paper as well. The socio-emotional behaviour measures non-cognitive skills of preschool children, while locus of control is used for adolescents' non-cognitive outcome.

Socio-emotional behaviour describes a child's behaviour in terms of feelings or relationships with family and peers. Goodman (1997) developed the Strength and Difficulties Questionnaire (SDQ), which assesses children's socio-emotional regulation. The SOEP uses a modified version of the SDQ to collect information on preschool children aged five/six. The construction of children's overall socio-emotional behaviour accounts for the fact that mothers answer the questionnaire related to children's emotional symptoms, peer problems or conduct problems and others, as the answering scale of several items is reversely coded accounting for potential positive skewness in mothers' rating.¹⁵

Although maternal rating of children's behaviour may result in measurement error, as long as this is unrelated to involuntary maternal job loss, it does not threaten the identification strategy of the paper. It is argued that mothers who lose a job are less likely to use a different reference group to rate their child's behaviour than mothers who do not. It may instead be more likely that the responses of working mothers compared to voluntarily "stay at home mothers" vary systematically, since working mothers may have fewer reference points for their child's behaviour. This paper therefore focuses only on working mothers. In addition, the SDQ construction ensures that each sample comprises 80% of the sample are categorized in "normal behaviour" and 10% are either "borderline" or "abnormal behaviour" (see <http://www.sdqinfo.org>). In the preschool sample 73% of children are classified "normal", 12% "abnormal" and 15% "borderline".

Socio-emotional behaviour is, so far, used in various educational and psychological studies as well as in a few economic studies (see for example Andersen et al., 2007; Datta Gupta and Simonsen, 2010; Ermisch, 2008; Ermisch et al., 2012; Felfe and Lalive, 2013; Müller et al., 2013). In the preschool sample children's SDQ ranges from 0 to 30 with a higher score representing a negative outcome of the child, e.g. having socio-behavioural problems. In order to compare all outcomes used in this paper in terms of standard deviations, the SDQ score is transformed to have a mean of zero and a standard deviation of 1.

Locus of control is the non-cognitive outcome in the adolescence sample based on the concept developed by Rotter (1966). The locus of control has been part of the youth

¹⁵Information on the reliability and construction of the SDQ, as well as the categorization into different behavioural groups can be found at <http://www.sdqinfo.org>

questionnaire since 2001 and adolescents report on a scale from 1 (completely disagree) to 7 (completely agree) regarding “what happens in life depends on me” or “what you achieve is a matter of luck” (see Weinhardt and Schupp, 2011, for a more detailed discussion). Factor analysis is used to extract two factors determining whether adolescents believe that their life depends on their own action (internal locus of control) or whether they believe that life is determined by others (external locus of control).

In this paper the analyses focus on internal locus of control, since children’s belief in self-determination may be altered by experiencing involuntary maternal job loss. Adolescents may perceive an involuntary job loss of their mother as unfair and imposed, which may modify their idea that “everything is possible as long as you work hard”. Further, a change in adolescents’ internal locus of control can have negative consequences later in life, as several studies in the economic literature show that individuals who believe in fate rather than in self-determination have negative educational or labour market outcomes (Caliendo et al., 2015; Cebi, 2007; Coleman and DeLeire, 2003; Heineck and Anger, 2010). The study by Caliendo et al. (2015) for example shows that individuals with a more external locus of control are less likely to leave unemployment than individuals with an internal locus of control.

4.4. *Conditioning variables*

Similar to OLS, propensity score matching requires that the selection is based on observable characteristics. The assumption that selection only exists on observables is known as *conditional independence assumption (CIA)* (for an overview of application of matching see Caliendo and Kopeinig, 2008). Under the conditional independence assumption, the exposure to treatment, here maternal job loss, is independent given a set of observable characteristics X . Given the richness of the SOEP, the CIA is more likely to hold, as a vast set of variables is available in the data. An advantage of propensity score methods is that, compared to OLS, estimates resulting from propensity score matching are less dependent on the functional form in the model (Dehejia and Wahba, 2002; Rosenbaum and Rubin, 1983, 1984).

Therefore, this paper relies on the assumption that the variables to predict involuntary maternal job loss are observable. The set of variables used to reweight children of the control group to match children of the treatment group is crucial for the identification strategy. I base the choice of conditioning variables, i.e., relevant characteristics that are observed pre-treatment and are used to match treated and untreated individuals, on other empirical studies investigating maternal employment and child well-being (Baum, 2003; Berger et al., 2005; Hill et al., 2005; Huff-Stevens and Schaller, 2011; James-Burdumy, 2005; Ruhm, 2008, 2009).

In all OLS and regression-adjusted matching models I use the following set of pre-treatment variables: child gender and migration background, monthly household income, maternal partnership, number of children in household, maternal employment status, maternal level of

education, maternal age at birth, paternal employment and years of schooling¹⁶, living in rural or urban areas, region of residence (East Germany vs. West Germany), maternal well-being and time dummies¹⁷ as covariates. In the preschool sample these variables are measured around birth of the child and in the adolescents sample at age six. All variables are presented in Table 1 indicating precisely at which point in time each variable was measured with respect to children’s age.

In addition, as a robustness check, I control for maternal working status after job loss to approximate mothers’ length of unemployment. This is either measured at age six of the child (preschool sample) or at age seventeen (adolescence sample). As a second crude approximation of maternal unemployment duration, all models control for regional unemployment rates, thus capturing the rigidity of the local labour market of mothers. Since the duration of unemployment is strongly linked to life satisfaction and overall well-being of mothers through which job loss might affect child outcomes (Clark et al., 2010; Knabe et al., 2010).

Furthermore, I look at maternal outcomes that might be potential mediators for job loss on child outcomes. Thus, in addition to the conditioning variables, which are measured pre-treatment, I also include some post-treatment variables in the descriptive table, such as overall life satisfaction of mothers, household income after job loss, and maternal non-cognitive skills (personality traits and locus of control) as additional controls. Maternal personality traits are measured by the so-called Big-Five concept in the German Socio-Economic Panel Study. The five factor model proposed by McCrae and Costa (1996) maps a person’s characteristics onto five dimensions describing individuals’ personality traits: Openness, conscientiousness, extroversion, agreeableness, and neuroticism. Due to sample size restrictions, only the *neuroticism* dimension is included in the analyses. It is the personality trait that correlates the most with children’s non-cognitive outcomes. Neuroticism comprises different aspects of social inhibition, anxiety, insecurity, or impulsiveness (for further information, see Almlund et al., 2011). Since maternal non-cognitive skills, overall life satisfaction and household income may be affected by job loss, I first assess the potential relationship between maternal outcomes and involuntary job loss. In a second step, I stepwise add these measures as potential mediators to the preferred model.

The descriptive comparison between the treatment and control groups shown in Table 1 suggests that non-cognitive outcomes of children differ by maternal job loss experience. The mean of preschoolers’ socio-emotional behaviour (SDQ) is 54% of a standard deviation higher for children whose mothers experienced a job loss. This difference is statistically significant and suggests a potential negative relationship between involuntary maternal job loss and children’s socio-emotional behaviour: the higher the total difficulties score, the higher a child’s socio-

¹⁶I refer to paternal characteristics although I cannot distinguish between biological or social fathers. Both variables are measured at the age of child outcomes (age 6 or age 17 respectively) to avoid further reductions in sample size due to partial unit non-response.

¹⁷Due to small sample size in the preschool sample, time dummies are not included in the analyses of involuntary maternal job loss and children’s socio-emotional behaviour. I control for a linear time trend instead.

emotional problems. For adolescents' internal locus of control, the difference between those in the treatment group and those in the control group is also significant, differing by 27% of a standard deviation, thus indicating that maternal job loss may decrease the likelihood to believe in self-determination.

To test whether the impact of involuntary maternal job loss on families varies by type of job loss experienced, I also compare all conditioning variables for treated mothers only, i.e. for mothers who experience a job loss by plant closure to those who experience a dismissal by employer to exclude that mothers differ by job loss type. Table A.1 in the appendix shows that most conditioning variables do not differ by type of job loss experienced. Only three characteristics differ significantly: Mothers, who experience dismissals worked at firms for shorter periods, work fewer hours, and in smaller firms compared to mothers who experience plant closures. Although mothers are similar across types of job loss, it might be that it is more likely for mothers to anticipate a dismissal than plant closure, as employers have to keep the term of notice. Table A.1 shows that mothers who experienced a dismissal are more likely to work after job loss, yet this difference is not statistically significant. The comparison suggests that it is possible to classify both types of job loss in one category of involuntary job loss.

With regard to propensity score matching, I have run appropriate tests to contrast covariate mean differences across matched groups to ensure that adequate matches have been obtained. Results from the balancing tests are shown in Table A.2 and A.3 in the appendix.¹⁸ They show that balancing mothers of the control group to match mothers of the treatment group was mostly successful in both samples.

¹⁸In addition, Table A.4 in the appendix shows results from linear probability models to estimate the propensity of job loss in both samples.

Table 1: Summary of children’s outcomes, all conditioning variables, and maternal outcomes by involuntary maternal job loss

	Sample of preschool children			Sample of adolescents		
	Mean		Mean diff.	Mean		Mean diff.
	No job loss	Job loss		No job loss	Job loss	
Child outcomes						
Socio-emotional behaviour	-0.04	0.50	-0.54**			
Internal locus of control				0.01	-0.25	0.27**
Personality traits (Big 5)						
Openness ¹	-0.00	0.02	-0.02	0.01	-0.10	0.11
Conscientiousness ¹	-0.00	0.07	-0.08	0.02	-0.10	0.12
Extroversion ¹	0.00	-0.04	0.04	0.01	-0.12	0.13
Agreeableness ¹	0.00	-0.06	0.07	-0.00	-0.09	0.08
Neuroticism ¹	-0.04	0.62	-0.66**	-0.02	-0.00	-0.02
German grade				2.91	2.95	-0.04
Mathematics grade				2.99	3.08	-0.09
Grade repetition				0.19	0.27	-0.08
Child & family characteristics						
Age of child (in months)	69.08	69.40	-0.32			
Gender (female=1)	0.50	0.47	0.03	0.45	0.55	-0.10
Migration background	0.15	0.27	-0.11	0.16	0.17	-0.01
Log(HH income) (at birth/age 6)	8.00	7.81	0.19	7.41	6.69	0.71***
Partnered (at birth/ age 6)	0.93	0.80	0.13*	0.94	0.92	0.02
Number of children in HH (at birth/ age 6)	1.79	1.53	0.26	2.09	2.08	0.01
Maternal characteristics						
Migration background	0.13	0.27	-0.14	0.13	0.13	-0.00
Working full time (prior birth)	0.45	0.47	-0.02			
Working part time (prior birth)	0.22	0.33	-0.11			
Working full time (at birth/ at age 6)	0.35	0.40	-0.05	0.30	0.38	-0.08
Working part time (at birth/ at age 6)	0.23	0.27	-0.04	0.34	0.30	0.04
Working hours (at age 6)				20.47	22.52	-2.05
Time at firm (at age 6)				4.23	3.66	0.57
Size of firm (at age 6)				5.37	4.87	0.50
Years schooling (at birth/ at age 6)	13.18	12.13	1.05	12.06	12.60	-0.54
University degree (at age 6)				0.22	0.33	-0.11*
No degree (at age 6)				0.15	0.13	0.02
Age at childbirth				27.60	28.15	-0.55
Age at childbirth (20-25)	0.06	0.13	-0.07	0.26	0.27	-0.00
Age at childbirth (25-30)	0.36	0.40	-0.04			
Age at childbirth (30-35)				0.21	0.27	-0.06
Age at childbirth (35+)	0.27	0.13	0.13	0.08	0.07	0.02
Paternal characteristics						
Working (yes/no) (at age 6/ at age 17)	0.78	0.73	0.04	0.80	0.65	0.15***
Years schooling (at age 6/ at age 17)	13.17	13.11	0.06	12.02	11.75	0.27
Regional characteristics						
Rural-urban (prior birth/ at age 6)	0.30	0.33	-0.03	0.32	0.23	0.08
Region East Germany (at birth/age 6)	0.31	0.40	-0.09	0.35	0.47	-0.12*
Location in 1989	0.35	0.47	-0.12	0.35	0.50	-0.15**
Maternal well-being						
Satisfied w/ being a mother around birth	0.15	0.27	-0.11			
Life satisfaction at 6				7.04	6.57	0.48**
Maternal employment post-job loss						
Regional unemployment rate	9.29	9.49	-0.19	12.55	14.20	-1.65**
Working (yes/no) (at age 6/at age 17)	0.88	0.87	0.01	0.92	0.82	0.10**
Maternal outcomes post-job loss						
Overall life satisfaction (at age 6/at age 17)	7.25	5.93	1.31***	6.81	6.57	0.24
Household income (at age 6/at age 17)	8.08	7.91	0.17	8.10	7.92	0.18***
Neuroticism (wave 2005)	-0.08	0.33	-0.41	-0.01	0.03	-0.04
Internal locus of control (wave 2005)				-0.01	0.07	-0.08
<i>N</i>		229			522	

Note: This table describes all conditioning variables for treatment and control groups. The first three columns present the means and mean differences of variables in the preschool sample; and columns four to six comprise means and mean differences in the adolescence sample. The age of the child at which variables are measured is indicated in parentheses in the utmost left column. Pretreatment variables are measured *at birth* for children in the preschool sample and *at age 6* for children in the adolescence sample. The post-job loss variables for employment as well as for maternal outcomes are measured at age 6 of the child in the preschool sample and at age 17 of the child for the adolescence sample. The post-job loss variables are not included in the main analyses of children’s outcomes using OLS or propensity score matching respectively. ¹Sample size N=224 in adolescence sample for the outcome *personality traits*, as the youth questionnaire only includes these since 2006. Source: SOEP v27 (waves 2001-2010). Own calculations, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5. Results

In this section the estimates of the impact of involuntary maternal job loss on children’s behavioural and non-cognitive outcomes are presented using OLS and propensity score methods. First, results from stepwise regressions are presented. Then the preferred OLS specification is compared to estimates of regression-adjusted propensity score matching. In the preferred model, estimates are obtained by controlling for all conditioning variables measured pre-treatment. In all tables only the coefficient of the explanatory variable of interest is depicted: involuntary job loss or plant closure and dismissal by employer as separate variables.¹⁹

5.1. *Preschool sample*

Table 2 presents the results of the correlation of involuntary job loss with children’s socio-emotional behaviour. Involuntary job loss is significantly associated with larger socio-emotional problems (SDQ). A child’s SDQ is estimated to increase by 51% of a standard deviation, if her mother loses a job due to plant closure or dismissal, implying that children are less stable with respect to socio-emotional behaviour (see column 6). Comparing the coefficient of the “full” OLS model (column 6) to the “raw” model (column 1) suggests that estimating the association of involuntary job loss on children’s SDQ is robust to including pre-job loss characteristics. A comparison of the size of the association of SDQ and involuntary job loss as opposed to child’s gender indicates that the effect of job loss is more than twice the size of child’s gender associated with children’s socio-emotional behaviour.²⁰ For girls, the SDQ is 25% of a standard deviation lower than that of boys. Adding two variables to the model estimated in column 6, namely maternal working status at age five/six of the child and regional unemployment rate, renders a similar relationship in terms of size and significance of the estimate (column 7). Controlling for these post-treatment measures approximates mothers’ length of unemployment and its result suggests that the experience of involuntary job loss may last longer than to the point where mothers return to work. As a next step, state and industry fixed effects are added to the model (column 8) to assess whether job loss occurs more frequently in areas with low quality education, which may actually underlie child outcomes. The results are robust and similar in size to whether industry and state fixed effects are included or not, yet, the significance level of maternal job loss decreases, as standard errors increase. Including state and industry fixed effects does not suggest that plant closure or dismissal are more likely to occur in lower quality areas.

As I analyse a combined measure of job ends that are plausibly exogenous, I also estimate two models where plant closure and dismissal are included as separate dummy variables (column 9 and 10 of Table 2). The estimates suggest that plant closure may affect socio-emotional

¹⁹All models with all covariates are available from the author upon request. For Table 2 and Table 3, I include full model regressions in the appendix (see Table A.5 and A.6).

²⁰The referred relationship is depicted in Table A.5, column 1.

behaviour more severely as the size of the coefficient is larger compared to dismissals. But due to a small sample size and few plant closure experiences the correlation is insignificant with large standard errors. The coefficient of dismissal also correlates positively with children’s socio-emotional behaviour, implying a negative impact, but is not statistically different from zero. Here standard errors and the size of the correlation are smaller compared to plant closure. Still, both reasons of job ending are positively associated with children’s socio-emotional behaviour suggesting that mothers’ experience of plant closure or dismissal may increase children’s socio-emotional problems.

In sum, stepwise including important control variables does not affect the “raw” correlation of children’s socio-emotional behaviour and involuntary job loss (column 1). The size of the effect remains mostly stable across all specifications. Yet, as discussed in Section 3, OLS estimates require not only that the selection on observables assumption holds, but also that the underlying relationship of maternal job loss and children’s socio-emotional behaviour is linear. Therefore, column 11 in Table 2 compares the estimate obtained from regression-adjusted propensity score matching to the preferred specification shown in column 6. Using propensity score matching also renders a negative impact of maternal job loss on children’s SDQ, which is larger in size (57% of a standard deviation) than the “full” OLS estimate (51% of a standard deviation, column 6). Looking at the standard errors of both models suggests that applying propensity score matching is more efficient than OLS, as the standard errors are smaller.

Table 2: Stepwise estimation of socio-emotional behaviour of preschool children and involuntary maternal job loss

	Socio-emotional behaviour										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Involuntary job loss	0.544* (0.3059)	0.546* (0.3056)	0.531* (0.3047)	0.543* (0.3167)	0.557* (0.3085)	0.510* (0.3042)	0.550* (0.3085)	0.598 (0.3819)			0.565** (0.2256)
Plant closure									0.857 (0.6582)	0.935 (0.6516)	
Dismissal by employer									0.334 (0.2956)	0.356 (0.3053)	
Family/child characteristics	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Paternal characteristics	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional characteristics	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal well-being	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Maternal employment (post)	No	No	No	No	No	No	Yes	Yes	No	Yes	No
State and industry fixed effects	No	No	No	No	No	No	No	Yes	No	No	No
N	229	229	229	229	229	229	229	224	229	229	226
R^2	0.018	0.067	0.114	0.124	0.135	0.146	0.160	0.252	0.150	0.164	0.439
Adjusted R^2	0.014	0.033	0.042	0.036	0.033	0.041	0.047	0.030	0.040	0.047	0.369

Note: Each cell depicts the effect of maternal job loss on socio-emotional behaviour of preschool children. Except for model (1) all regressions include a linear time trend. The first column comprises the “raw” correlation between maternal job loss and children’s socio-emotional behaviour. The second column includes family and child characteristics (child’s gender, migration background, household income, partnered, and number of children in household) in the regression; the third column adds maternal socio-economic status variables (maternal employment, maternal education, and age at birth); and the fourth column adds paternal years of education and working status to the set of conditioning variables. The fifth column adds regional characteristics (region of residence (East vs. West Germany), rural-urban dummy) and the sixth column controls for maternal well-being prior to job loss (satisfaction with being a mother). The seventh column includes maternal working status after job loss at age 6 to approximate length of unemployment as well as regional unemployment rate. In column 8 state and industry fixed effects are included. Columns 9 and 10 estimate involuntary job loss with separate dummies for plant closure or dismissal by employer using all variables of the preferred specification in column 6 and employment post-job loss respectively. Model (6) comprises the preferred set of conditioning variables and therefore column 11 depicts regression-adjusted matching using the same specification as the sixth column. Own calculations. Source: SOEP v27 (waves 2008-2010). Robust standard errors in parentheses, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5.2. Adolescence sample

Table 3 presents the stepwise estimates of the relationship of adolescents' internal locus of control and maternal job loss. The estimates in all specifications indicate that maternal job loss decreases adolescents' belief in self-determination by around 26% of a standard deviation, meaning that adolescents whose mothers experience plant closure or dismissal by employer are less likely to believe that working hard or striving for ones own success will help them achieve their own goals. Comparing the coefficient of the "full" OLS model (column 6) to the one of the "raw" model (column 1) suggests that estimating the association of involuntary job loss with adolescents' internal locus of control is robust to including pre-treatment characteristics. Analogue to the estimations for the preschool sample, I add all pre-treatment variables stepwise to the estimation of job loss on adolescents' internal locus of control. Further I also control for maternal employment and regional unemployment rate post-job loss (column 7). The coefficient again remains nearly unchanged in size and significance level suggesting that the experience of job loss impacts longer than up to the point where a mother starts working again. Controlling for state and industry fixed effects does not change the estimate either, suggesting that maternal job loss does not only occur in low quality areas.

In order to differentiate involuntary job loss, column 9 and column 10 show the association of job loss separately for plant closure and dismissal by employer. The direction of the effect remains negative for both types of job loss, but the coefficient of plant closure is smaller and not statically different from zero. The results indicate that job ends due to dismissal by employer significantly decrease adolescents' internal locus of control by around 38% of a standard deviation. However by splitting the incidence of involuntary job loss, the coefficient of plant closure is bound to be insignificant as fewer mothers are exposed to firm closure compared to dismissals.

Again the results from the stepwise estimation suggest that the effect of maternal job loss on adolescents' internal locus of control is robust. The size of the effect remains stable across all specifications. Similar to the preschool sample, column 11 compares the coefficient from regression-adjusted propensity score matching to the preferred model (column 6). The significance of the estimated coefficient remains similar and the size of the effect slightly decreases to 22% of a standard deviation. Overall, the results from Table 3 provide evidence that involuntary maternal job loss is associated with children's non-cognitive outcomes. The estimates from regression-adjusted propensity score matching are more efficient than those obtained from OLS. When looking at the results from the "full" OLS model without appropriately correcting for the selection effect of maternal job loss, the actual effect is overestimated.

Interpreting the results obtained in both samples against the background of Cunha and Heckman (2010) suggests that young children are worse off, as early investments are found to have multiplier effects in later childhood. Thus, although experiencing maternal job loss in later childhood has a negative impact on non-cognitive skills, during early childhood this impact may worsen the development in later childhood.

Table 3: Stepwise estimation of internal locus of control of adolescents and involuntary maternal job loss

	Internal locus of control										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Involuntary job loss	-0.268* (0.1436)	-0.244* (0.1387)	-0.247* (0.1342)	-0.248* (0.1380)	-0.248* (0.1403)	-0.258* (0.1407)	-0.265* (0.1407)	-0.261* (0.1416)			-0.216* (0.1247)
Plant closure									-0.066 (0.1831)	-0.084 (0.1858)	
Dismissal by employer									-0.386** (0.1811)	-0.384** (0.1800)	
Family/child characteristics	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal characteristics	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Paternal characteristics	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional characteristics	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maternal well-being	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Maternal employment (post)	No	No	No	No	No	No	Yes	Yes	No	Yes	No
State and industry fixed effects	No	No	No	No	No	No	No	Yes	No	No	No
<i>N</i>	522	522	522	522	522	522	522	522	522	522	521
<i>R</i> ²	0.007	0.104	0.137	0.139	0.150	0.152	0.154	0.205	0.155	0.157	0.283
Adjusted <i>R</i> ²	0.006	0.077	0.088	0.083	0.089	0.089	0.088	0.095	0.090	0.089	0.229

Note: Each cell depicts the effect of maternal job loss on internal locus of control of adolescents. Except for model (1) all regressions include year fixed effects. The first column comprises the “raw” correlation between maternal job loss and adolescents’ internal locus of control. The second column includes family and child characteristics (child’s gender, migration background, household income, partnered, and number of children in household) in the regression; the third column adds maternal socio-economic status variables (maternal employment, maternal education, and age at birth); and the fourth column adds paternal years of education and working status to the set of conditioning variables. The fifth column adds regional characteristics (region of residence (East vs. West Germany), rural-urban dummy) and the sixth column controls for maternal well-being prior to job loss (life satisfaction). The seventh column includes maternal working status after job loss at age 17 to approximate length of unemployment as well as regional unemployment rate. In column 8 state and industry fixed effects are included. Columns 9 and 10 estimate involuntary job loss with separate dummies for plant closure or dismissal by employer using all variables of the preferred specification in column 6 and employment post-job loss respectively. Model (6) comprises the preferred set of conditioning variables and therefore column 11 depicts regression-adjusted matching using the same specification as the sixth column. Own calculations. Source: SOEP v27 (waves 2001-2010). Robust standard errors in parentheses, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5.3. *Different child outcomes*

This section looks at further outcomes measuring child development. First, another non-cognitive skills measure, namely personality traits, is examined as an additional outcome. In addition to socio-emotional behaviour and internal locus of control, personality traits are also included in both samples – preschool children and adolescence. However, in the adolescence sample personality traits are only surveyed for a subgroup since 2006. Looking at these particular non-cognitive skills reduces the sample size of the adolescence sample to 224 observations. The second set of outcomes examines the association of maternal job loss on grades (German and mathematics) and grade repetition, which facilitates determining if the evidence found in this paper relates to previous findings in the literature.

The measures of personality traits are based on the five-factor model. In the preschool sample personality traits are surveyed with a modified measure based on Asendorpf and van Aken (2003) and in the adolescence sample based on McCrae and Costa (1996). Studies in personality psychology show that parental rating of three-to-five-year-old children’s personality varies in five dimensions: extroversion, neuroticism, conscientiousness, agreeableness, and intellect (openness to experience) (e.g., Kohnstamm et al., 1998). Following Asendorpf et al. (2007), the maternal ratings of their young children for ten items can be transferred to five dimensions of personality traits. For adolescents, the items included in the youth questionnaire are similar to those described in Section 4.4. regarding maternal personality traits. Similar to the locus of control, adolescents rate items on a scale from 1 (completely disagree) to 7 (completely agree). For both samples the surveyed personality characteristics are summed in each dimension and transformed to a standardized score with a mean of zero and a standard deviation of one.

Table 4 presents estimates obtained from regressing involuntary maternal job loss on the five personality traits for both samples using the preferred specification.²¹ For the adolescence sample, no association of maternal job loss on adolescents’ personality traits can be found, which cannot be further interpreted due to the drop in sample size. It might either be the case that job loss does not impact personality traits or that the sample size lacks statistical power to estimate the effect of maternal job loss. For preschool children, on the other hand, a negative effect of maternal job loss on social behaviour is replicated with another outcome measure, as the scale of neuroticism increases for treated children. Neuroticism depicts different notions of social inhibition, insecurity, or impulsiveness (for further information, see Almlund et al., 2011).

²¹The preferred specification is shown in column 6 of Table 2 for preschool children and in column 6 of Table 3 for adolescents.

Table 4: Estimation of other child outcomes and involuntary maternal job loss (OLS)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Open- ness	Conscient- iousness	Extra- version	Agreeable- ness	Neuroticism	German grade	Math grade	Grade repetition
Panel A : Sample of preschool children								
Involuntary job loss	0.142 (0.2052)	0.071 (0.2739)	0.060 (0.2849)	-0.152 (0.3587)	0.592** (0.2571)			
<i>N</i>	228	229	229	229	229			
<i>R</i> ²	0.144	0.182	0.103	0.153	0.129			
Adjusted <i>R</i> ²	0.038	0.081	-0.008	0.049	0.021			
Panel B: Sample of adolescents								
Involuntary job loss	-0.135 (0.2345)	-0.143 (0.2421)	-0.149 (0.2330)	-0.109 (0.2255)	-0.185 (0.2118)	0.147 (0.1007)	0.115 (0.1501)	0.109* (0.0580)
<i>N</i>	224	224	224	224	224	518	518	522
<i>R</i> ²	0.186	0.153	0.123	0.150	0.192	0.166	0.098	0.127
Adjusted <i>R</i> ²	0.054	0.017	-0.019	0.012	0.062	0.104	0.031	0.062
Panel C: Sample of adolescents								
Plant closure	0.129 (0.2927)	0.053 (0.3710)	-0.262 (0.3303)	0.268 (0.3431)	-0.056 (0.3072)	0.015 (0.1376)	0.212 (0.2062)	0.151* (0.0892)
Dismissal by employer	-0.312 (0.3108)	-0.275 (0.3050)	-0.073 (0.3042)	-0.363 (0.2994)	-0.272 (0.2568)	0.235* (0.1309)	0.050 (0.1952)	0.081 (0.0729)
<i>N</i>	224	224	224	224	224	518	518	522
<i>R</i> ²	0.191	0.156	0.124	0.159	0.193	0.168	0.099	0.127
Adjusted <i>R</i> ²	0.055	0.015	-0.023	0.019	0.058	0.104	0.029	0.061

Note: Each cell depicts the effect of maternal job loss on other child outcomes, namely personality traits in the sample of preschool children and of adolescents; and grades and grade repetition only in the sample of adolescents. Panel A contains estimations on personality traits in the preschool sample and Panel B depicts estimates of involuntary job loss on personality traits and “cognitive ability” in adolescence sample. Panel C depicts the same effects as Panel B splitting involuntary job loss in plant closure and dismissal by employer for the sample of adolescents. All models in the sample of preschool children include a linear time trend and the preferred set of conditioning variables (column 6, Table 2), and in the sample of adolescents all models comprise year fixed effects and all controls of the preferred model (column 6, Table 3). Own calculations. Source: SOEP v27 (waves 2001-2010). Robust standard errors in parentheses, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

With regard to the previous literature, this paper examines German and mathematics grades as well as grade repetition as additional outcomes, since previous evidence finds spillover effects on these measures of educational attainment (Huff-Stevens and Schaller, 2011; Kalil and Ziol-Guest, 2008; Rege et al., 2011, e.g.). Kalil and Ziol-Guest (2008) estimate children’s academic performance as a function of parental employment patterns using U.S. survey data. They find no significant correlation between involuntary maternal job loss and children’s grade repetition. Huff-Stevens and Schaller (2011) analyse job loss and children’s likelihood of grade repetition based on the same data, yet they define involuntary job ends more narrowly, focusing only on dismissals and plant closure.²² Applying child fixed effects, Huff-Stevens and Schaller (2011) show that plausibly exogenous displacements of parents are detrimental for children’s academic performance. Parental job loss increases children’s likelihood of repeating a grade by 0.8 percentage points. Furthermore, Rege et al. (2011) look at the effect of displacements of only plant closures on academic performance measured in terms of grade point average (GPA) at age sixteen. They find that fathers’ exposure to plant closure decreases children’s grade point average (GPA) by 6.3% of a standard deviation, where mothers’ job loss has an insignificant

²²Kalil and Ziol-Guest (2008) include quitting, dismissal or illness amongst others in their definition of job loss.

but positive effect on children’s GPA. To approximate GPA this paper looks at German and mathematics grades.²³

Table 4 shows that mother’s involuntary job loss increases adolescents’ likelihood of grade repetition by 12 percentage points (Panel B, column 8), but has no effect on students’ grades.²⁴ Looking at the effect of involuntary job loss with separate dummies (Panel C) indicates that dismissal by employer marginally increases adolescents’ German grade, rendering a negative effect. The correlation of job loss and grade repetition on the other hand is solely found for mothers experiencing plant closure (Panel C, column 8).²⁵ The results in Table 4 can be cautiously compared to previous evidence found by Huff-Stevens and Schaller (2011), as they also look at dismissals and plant closure. The direction of the effect is very similar to what Huff-Stevens and Schaller (2011) find, while the size of the effect is not: In their OLS specification they find an increase of 1.7 percentage points due to parental job loss (compared to 12 percentage points in Table 4, Panel B, column 8). Looking at grades the results found in this paper differ to those reported by Rege et al. (2011). Although I also find a negative effect of plant closure on grade repetition, my results using the combined measure of involuntary job loss may still be biased. But, the differences in results may also depend on the quality of family environment after mothers experience a job loss. The quality within families with maternal job loss might be relatively worse in Germany compared to Norway. In general, the analysis regarding other child outcomes shows that results found in previous studies are (to some extent) replicated in this sample.

5.4. *Maternal outcomes after job loss*

At the beginning of this paper potential mediators through which an involuntary job loss might affect children’s outcomes are discussed. This section tests the hypotheses of Section 2 by analysing the relationship of involuntary job loss with these outcomes. Regressing involuntary maternal job loss on life satisfaction, household income and maternal non-cognitive skills may reveal potential channels through which mothers’ experiences may be linked to child outcomes.

In the sample of preschool children maternal life satisfaction significantly decreases for mothers who experience a job loss (Table 5, Panel A, column 1). The overall life satisfaction after job loss decreases by 1 scale point.²⁶ All models examining life satisfaction and household income in Table 5 include the pre-treatment level of the potential mechanism variables to

²³In Germany grades range from 1 (very good (A)) to 6 (unsatisfactory (F)), therefore, a higher average represents poorer performance in the classroom.

²⁴Table A.7 in the appendix shows the results of Panel A and B using regression-adjusted propensity score matching. Here the negative impact of job loss on neuroticism is also found in the sample of preschool children. Further the results for grade repetition are confirmed in the adolescence sample as well; and in addition, a marginal significant impact of job loss on German grade is identified.

²⁵Due to small sample size in the sample of preschool children, I refrain from looking at effects of plant closure and dismissal separately in this sample.

²⁶In the SOEP, overall life satisfaction is measured with a 11-point Likert-type-scale ranging from 0 (absolutely not satisfied) to 10 (absolutely satisfied).

control for individual specific starting points. In the adolescence sample a significant decrease in household income after job loss is observed (Table 5, Panel B, column 2). For mothers in the preschool sample, I find no effect of job loss on household income, as women with small children often only add a small fraction to the household income. Interestingly for mothers of children aged seventeen, overall life satisfaction is not affected by the experience of displacement. The correlation found for mothers of young children could suggest that they are more stressed or frustrated about their job loss than mothers of older children. Maternal personality traits – measured using the dimension neuroticism and the internal locus of control – are not significantly affected by job loss: neither in the preschool nor in the adolescence sample (Table 5, Panel A/B, column 3/4).²⁷ Yet, unfortunately for the analyses of this study, personality traits are only measured in the years 2005 and 2009/2010, which rules out the possibility to include the levels prior to job loss.

In order to rule out varying impacts on maternal outcomes by job loss type, i.e. plant closure and dismissal by employer, Panel C in Table 5 splits the analyses of involuntary job loss in the adolescence sample. The significant decrease in household income is found for both types of job loss (Table 5, Panel C, column 2), which may suggest that stress due to financial restrictions is similar for both types of job loss. Since most maternal outcomes are not significantly related with plant closure or dismissal by employer, it remains speculation how the different job loss types impact on these maternal outcomes. Yet, it is worth noticing that plant closure positively correlates with life satisfaction and maternal non-cognitive skills²⁸, whereas negative coefficients are obtained for dismissal by employer. Thus, it may be that the overall negative effect on these outcomes are driven by maternal experience of dismissal, which may lead to a negative change in maternal well-being.

²⁷Table A.8 in the appendix shows the results of Panel A and B using regression-adjusted propensity score matching. Here job loss increases the likelihood of maternal neuroticism in the sample of preschool children. This suggests that the emotional stability of mothers with young children decreases after job loss, although this has to be interpreted with caution, as I cannot control for pre-treatment neuroticism.

²⁸The association of plant closure and internal locus of control is even marginally significant.

Table 5: Estimation of maternal outcomes and involuntary maternal job loss (OLS)

	(1) Life satisfaction	(2) Household income	(3) Neuroticism	(4) Internal locus of control
Panel A: Sample of preschool children				
Involuntary job loss	-1.053*** (0.3765)	-0.001 (0.0928)	0.363 (0.2711)	
<i>N</i>	228	229	228	
<i>R</i> ²	0.304	0.755	0.120	
Adjusted <i>R</i> ²	0.214	0.725	0.011	
Panel B: Sample of adolescents				
Involuntary job loss	-0.004 (0.2150)	-0.129** (0.0501)	0.009 (0.1436)	0.115 (0.1555)
<i>N</i>	522	521	522	516
<i>R</i> ²	0.270	0.511	0.050	0.104
Adjusted <i>R</i> ²	0.216	0.475	-0.020	0.037
Panel C: Sample of adolescents				
Plant closure	0.182 (0.3228)	-0.129* (0.0771)	0.043 (0.1654)	0.412* (0.2370)
Dismissal by employer	-0.129 (0.2690)	-0.129** (0.0629)	-0.013 (0.1988)	-0.090 (0.1896)
<i>N</i>	522	521	522	516
<i>R</i> ²	0.271	0.511	0.050	0.111
Adjusted <i>R</i> ²	0.215	0.474	-0.022	0.042

Note: Each cell depicts the effect of maternal job loss on maternal outcomes. Maternal outcomes include overall life satisfaction, household income, and the personality dimension neuroticism in both samples. In the sample of adolescents internal locus of control is also assessed as maternal outcome post-job loss. Panel A contains estimations on maternal outcomes in the sample of preschool children and Panel B depicts estimates in the sample of adolescents. Panel C depicts the same effects as Panel B splitting involuntary job loss in plant closure and dismissal by employer. All models in the sample of preschool children include a linear time trend and the preferred set of conditioning variables (column 6, Table 2), and in the sample of adolescents all models comprise year fixed effects and all controls of the preferred model (column 6, Table 3). Own calculations. Source: SOEP v27 (waves 2001-2010). Robust standard errors in parentheses, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5.5. Maternal outcomes as potential mediators of job loss

In Table 6 the pre- and post-treatment levels of the potential mediators – if they are available – are added stepwise to the preferred model. Panel A of Table 6 depicts how the potential channels of maternal job loss affect preschool children’s non-cognitive skills. Controlling for maternal life satisfaction pre- and post-job loss decreases the effect of maternal job loss on preschoolers’ SDQ in size and significance. Job loss still increases children’s socio-emotional behaviour, but only by 38% of a standard deviation instead of 51%. Further adding household income after job loss or mothers’ level of neuroticism also decreases the significance of job loss on socio-emotional behaviour.²⁹ The estimates suggest that maternal emotional balance might be affected, as maternal life satisfaction is significantly lower after involuntary job loss (see Panel A,

²⁹The adjusted R-squared estimates remain fairly stable across all models in Panel A of Table 6, thus suggesting, that neither household income after job loss nor mothers’ level of neuroticism explain any additional variance of children’s socio-emotional behaviour compared to the level of life satisfaction after job loss.

Table 5, column 1) in the preschool sample and including life satisfaction as additional control variable renders the association of job loss with SDQ insignificant. The evidence provided by Table 6 for the preschool sample (Panel A, column 1) shows a small indication in favour of the emotional balance hypothesis and suggests that maternal life satisfaction after displacement may be a possible channel of job loss at this childhood stage.

Table 6: Estimation of non-cognitive skills including maternal outcomes after involuntary job loss (OLS)

Panel A: Sample of preschool children	Socio-emotional behaviour			
	(1)	(2)	(3)	(4)
Involuntary job loss	0.374 (0.2918)	0.376 (0.2888)	0.344 (0.2767)	– –
Life satisfaction (post)	Yes	Yes	Yes	–
HH income (post)	No	Yes	Yes	–
Neuroticism (post)	No	No	Yes	–
Internal locus of control (post)	No	No	No	–
<i>N</i>	229	229	228	–
<i>R</i> ²	0.174	0.179	0.201	–
Adjusted <i>R</i> ²	0.068	0.069	0.089	–
Panel B: Sample of adolescents	Internal locus of control			
	(1)	(2)	(3)	(4)
Involuntary job loss	-0.258* (0.1405)	-0.257* (0.1446)	-0.256* (0.1447)	-0.272* (0.1436)
Life satisfaction (post)	Yes	Yes	Yes	Yes
HH income (post)	No	Yes	Yes	Yes
Neuroticism (post)	No	No	Yes	Yes
Internal locus of control (post)	No	No	No	Yes
<i>N</i>	522	521	521	515
<i>R</i> ²	0.154	0.153	0.153	0.172
Adjusted <i>R</i> ²	0.089	0.087	0.085	0.102

Note: Each cell depicts the effect of maternal job loss either on socio-emotional behaviour for preschool children or the internal locus of control for adolescents. Panel A contains estimations in the preschool sample and Panel B depicts estimates of involuntary job loss in the adolescence sample. The first column includes maternal overall life satisfaction after job loss in the regression. The second column adds household income after job loss and the third column includes maternal personality dimension neuroticism as additional control variable. The last column of this table adds maternal internal locus of control to the model only for the sample of adolescents (Panel B). All models in the sample of preschool children include a linear time trend and the preferred set of conditioning variables (column 6, Table 2), and in the sample of adolescents all models comprise year fixed effects and all controls of the preferred model (column 6, Table 3). Own calculations. Source: SOEP v27 (waves 2001-2010). Robust standard errors in parentheses, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In the adolescence sample, the maternal outcome measures used to address underlying mechanisms of displacement are not sufficient to disentangle potential mediator effects. Panel B of Table 6 suggests that, unlike the preschool sample, adding post-treatment life satisfaction or household income does not influence the correlation of involuntary job loss with adolescents' non-cognitive skills, as the estimate of maternal job loss remains similar in size and significance

compared to the preferred estimate. Maternal personality traits do also not add any further explanatory power to adolescents' internal locus of control. The coefficient of involuntary job loss remains similar in size and significance across all specifications (Table 6, Panel B). In addition, mothers internal locus of control correlates with those of their children.³⁰ Further splitting involuntary job loss into plant closure and dismissal by employer shows that the found association between dismissals and adolescents' internal locus of control remains fairly stable (Table A.9 in the appendix).³¹

6. Sensitivity analysis

In this section robustness tests are carried out. First, a small robustness test is conducted to examine the plausibility of the propensity score method using propensity score weighting. The average treatment effect of the treated (ATT) can also be identified by propensity score weighted regressions (see Hirano and Imbens, 2001). To estimate the ATT the regression of non-cognitive skills on involuntary job loss is weighted by assigning $w = 1$ to mothers who lose their job ($D = 1$), and $w = \frac{P(X)}{(1-P(X))}$ to mothers of the control group ($D = 0$). A critical aspect of using the estimated propensity score as weight is its sensitivity to large estimated propensity scores, since these large values receive a larger weight. This problem decreases with sample size as each observation is less relevant for estimating the coefficient of interest. By restricting the estimations after treatment to the common support area, the problem of "large propensity score values" should have only a minor impact.

Second, the imposed sample choice is tested by dropping two cohorts from the analysis exemplified for the adolescence sample. Finally, for the sample of adolescents an alternative cut-off point of maternal job loss is specified to check whether the estimates are dependent on its definition. Instead of age ten as cut-off I restrict job loss starting from age twelve onward, since in three German federal states transition from primary to secondary school takes place after grade six. Table 7 displays the results for these robustness checks. In general, the robustness tests support the choices applied to the data as well as the use of propensity score methods in addition to OLS. Furthermore, matching and weighting with the propensity score may be necessary to assess the relationship of involuntary maternal job loss on children's non-cognitive skills, as estimates from propensity score methods are more efficient than those obtained from OLS. Further, Table 7 shows that the coefficients remain similar in size and in significance levels, except for the cut-off at age twelve. Yet, this may likely follow from fewer observed numbers of displacements.

³⁰The results for the entire model are available from the author upon request.

³¹Including maternal non-cognitive skills slightly reduces the size of the coefficient to 37.9% of a standard deviation and explains some additional variance of adolescents' internal locus of control (Table A.9, column 3 and 4).

Table 7: Estimation of internal locus of control and involuntary maternal job loss using different specifications

	Internal locus of control		
	(1) Propensity score weighting	(2) Only cohorts 1986-1994	(3) Cut-off at age 12
Involuntary job loss	-0.218* (0.1222)	-0.293* (0.1694)	
Involuntary job loss (age 12)			-0.199 (0.1779)
<i>N</i>	522	412	522
<i>R</i> ²	0.295	0.185	0.148
Adjusted <i>R</i> ²	0.243	0.111	0.085

Note: Each cell depicts the effect of maternal job loss on adolescents' internal locus of control. All regressions include year fixed effects and the preferred set of conditioning variables included in column (6) of Table 3. The first column estimates the effect of maternal job loss using regression-adjusted propensity score weighting. The second column shows estimates of involuntary maternal job loss only for birth cohorts 1986-1994, and the third column assesses maternal job loss occurring from age 12 onward instead of age 10, which is the cut-off date used throughout the paper to measure maternal job loss incidences in the sample of adolescents. Both models (column 2 and 3) are analysed using OLS. Own calculations. Source: SOEP v27 (waves 2001-2010). Robust standard errors in parentheses, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

7. Conclusion

This paper analyses the effect of involuntary maternal job loss on children's behaviour and non-cognitive skills. I find that an involuntary job loss increases socio-emotional problems in preschool children with 51% of a standard deviation and decreases internal locus of control among adolescents with 26% of a standard deviation.

To identify the relationship between involuntary job loss and children's skills, this paper uses ordinary least squares and propensity score matching - given the richness of the SOEP, a large set of confounding variables can be used to find nearly identical pairs. Yet, it is still possible that some child or maternal characteristics that are difficult to measure may lead to maternal job loss. Thus, findings in this paper may at least be interpreted as associations - showing that maternal job loss, which is plausibly exogenous, has predictive value for socio-emotional behaviour in early childhood and internal locus of control in adolescence.

Using stepwise regression and regression-adjusted matching, this paper finds that children's behaviour and non-cognitive skills are negatively associated with involuntary maternal job loss. Maternal job loss increases children's socio-emotional problems and decreases adolescents' perceived belief of self-determination. In addition, this paper finds also a negative association of maternal job loss and adolescents' grade repetition. Mothers' job loss significantly increases the likelihood of grade repetition for adolescents. This finding is in contrast to positive findings of maternal job loss using other cognitive outcomes, i.e. grade point average (Rege et al., 2011). Yet, one limitation of this study is, that I cannot look at displacements of only plant closures.

Thus, the negative association of involuntary maternal job loss may still be biased, because dismissal by employer is likely to be driving the found relationship with children's non-cognitive skills, at least for the sample of adolescents.

The findings on maternal outcomes considered to be potential mediators of job loss indicate that mothers' stress or frustration may impact the mother-child relationship after job loss. The analyses of potential mediators shed some light on underlying mechanisms, but changes in income and life satisfaction cannot completely explain the relationship between maternal job loss and adolescents' non-cognitive skills, as the coefficient of job loss remains significant. In addition I control for post-treatment employment - a large fraction of mothers is employed after job loss - in one specification and the found increase in socio-emotional problems or decrease in internal locus of control remain. This may suggest that employment after job loss might not immediately reduce the stress from job ending experiences.

Provided that other future studies confirm the findings of this paper (that is based on a relatively small sample) policy makers – as well as families – should acknowledge and take into account that unemployment is likely to affect not only the individuals hit by job loss but also the behaviour and non-cognitive skills of children in the family. Helping mothers to be less stressed or discouraged after job loss may be beneficial for children's non-cognitive skills. These non-cognitive skills are not only important predictors for a child's educational and labour market success (Caliendo et al., 2015; Cebi, 2007; Coleman and DeLeire, 2003; Heineck and Anger, 2010), but also for society as a whole (Heckman et al., 2010). Despite the acknowledged limitations, this paper demonstrates that not only changes in income, but also in maternal well-being should be considered when looking at effects of job loss on children.

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Appendix

Tables

Table A.1: Summary statistics of adolescents' outcomes, all conditioning variables, and maternal outcomes post-job loss comparing only treated mothers by type of job loss

	Job loss types		
	Mean		Mean diff.
	Dismissal by employer	Plant closure	
Child outcomes			
Internal locus of control	-0.42	-0.00	-0.42
Personality traits (Big 5)			
Openness ¹	-0.33	0.23	-0.56
Conscientiousness ¹	-0.11	-0.09	-0.02
Extroversion ¹	-0.06	-0.21	0.14
Agreeableness ¹	-0.42	0.40	-0.83**
Neuroticism ¹	-0.11	0.15	-0.26
German grade	3.06	2.79	0.26
Mathematics grade	3.03	3.17	-0.14
Grade repetition	0.25	0.29	-0.04
Child & family characteristics			
Gender (female=1)	0.50	0.63	-0.13
Migration background	0.19	0.13	0.07
Log(HH income) (at age 6)	6.69	6.69	-0.00
Partnered (at age 6)	0.92	0.92	0.00
Number of children in HH (at age 6)	2.17	1.96	0.21
Maternal characteristics			
Migration background	0.14	0.13	0.01
Working full time (at age 6)	0.31	0.50	-0.19
Working part time (at age 6)	0.28	0.33	-0.06
Working hours (at age 6)	18.31	28.83	-10.53**
Time at firm (at age 6)	2.08	6.03	-3.95***
Size of firm (at age 6)	3.92	6.29	-2.38**
Years schooling (at age 6)	12.90	12.15	0.76
University education (at age 6)	0.33	0.33	0.00
No degree (at age 6)	0.08	0.21	-0.13
Age at childbirth	28.28	27.96	0.32
Age at childbirth (20-25)	0.25	0.29	-0.04
Age at childbirth (30-35)	0.25	0.29	-0.04
Age at childbirth (35+)	0.08	0.04	0.04
Paternal characteristic			
Working (at age 17)	0.72	0.54	0.18
Years of schooling (at age 17)	11.86	11.57	0.30
Regional characteristics			
Rural urban (at age 6)	0.22	0.25	-0.03
Region East Germany (at age 6)	0.42	0.54	-0.12
Location in 1989	0.44	0.58	-0.14
Maternal well-being			
Life satisfaction (at age 6)	6.56	6.58	-0.03
Maternal employment post-job loss			
Regional unemployment rate	13.46	15.30	-1.83
Mother working (at age 17)	0.86	0.75	0.11
Maternal outcomes post-job loss			
Overall life satisfaction (at age 17)	6.47	6.71	-0.24
Household income (at age 17)	7.97	7.86	0.11
Neuroticism (2005)	0.01	0.06	-0.05
Internal locus of control (2005)	-0.15	0.40	-0.55*

Note: Summary statistics of all conditioning variables for treated mothers in the sample of adolescents. The first three columns present the means and mean differences of variables for mothers who experienced a dismissal by employer; and columns four to six comprise means and mean differences of mothers who experienced a plant closure. ¹ Sample size N=224 for the outcome *personality traits*, as the youth questionnaire only includes these since 2006. Source: SOEP v27 (waves 2001-2010). Own calculations, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.2: Descriptive statistics of the sample of preschool children - before and after matching

Variable	Means	Means		Standard. Bias (%)	
	Job loss	unmatched	matched	unmatched	matched
Child & family characteristics					
Age of child (in month)	69.40	69.08	69.40	8.40	-0.10
Gender (female=1)	0.47	0.50	0.47	-5.63	0.30
Migration background	0.27	0.15	0.24	27.25	6.82
Log(HH income) (at birth)	7.81	8.00	7.88	-38.74	-13.69
Partnered (at birth)	0.80	0.93	0.86	-36.08	-15.94
Number children in HH (at birth)	1.53	1.79	1.58	-32.02	-6.31
Maternal characteristics					
Migration background	0.27	0.13	0.23	35.11	8.26
Working full time (prior birth)	0.47	0.45	0.48	3.56	-2.46
Working part time (prior birth)	0.33	0.22	0.30	24.00	6.20
Working full time (at birth)	0.40	0.35	0.38	11.01	3.99
Working part time (at birth)	0.27	0.23	0.30	8.57	-6.53
Years of schooling (at birth)	12.13	13.18	12.34	-44.38	-9.76
Age at childbirth (20-25)	0.13	0.06	0.11	24.12	8.40
Age at childbirth (25-30)	0.33	0.32	0.35	3.26	-3.22
Age at childbirth (30-35)	0.40	0.36	0.37	9.09	6.15
Age at childbirth (35+)	0.13	0.27	0.18	-33.25	-11.64
Paternal characteristics					
Working (yes/no) (at age 6)	0.73	0.78	0.76	-9.66	-5.59
Years of schooling (at age 6)	13.11	13.17	13.13	-2.59	-0.81
Missing identifier	0.20	0.11	0.17	25.28	7.94
Missing info on education	0.27	0.20	0.24	15.27	6.95
Regional characteristic					
Rural-urban (prior birth)	0.33	0.30	0.34	7.23	-0.41
Region East Germany (at birth)	0.40	0.31	0.40	17.87	0.46
Location in 1989	0.47	0.35	0.44	24.32	4.71
Maternal well-being					
Satisfied w/ being mother (around birth)	0.27	0.15	0.25	27.25	3.49
Time trend					
Year child outcome is measured	2009.00	2009.04	2009.00	-5.26	-0.25

Note: Summary statistics of all conditioning variables for treated, unmatched and matched control individuals. The first two columns present the means of selected variables before treatment for treatment and control groups. The third column displays the standardised per cent bias before matching. It is the per cent difference of the sample means in the treatment and the matched control sample as a percentage of the square root of the average of the sample variances in both groups. The fourth column shows the standardised per cent bias after matching. Own calculations. Source: SOEP v27 (waves 2008-2010).

Table A.3: Descriptive statistics of the sample of adolescents - before and after matching

Variable	Means	Means		Standard. Bias (%)	
	Job loss	unmatched	matched	unmatched	matched
Child & family characteristics					
Gender (female=1)	0.55	0.45	0.54	19.96	2.84
Migration background	0.17	0.16	0.17	2.34	-0.22
Log(HH income) (at age 6)	6.69	7.41	6.80	-35.01	-4.73
Partnered (at age 6)	0.92	0.94	0.91	-6.99	2.68
Number of children in HH (at age 6)	2.08	2.09	2.10	-1.18	-1.97
Maternal characteristics					
Migration background	0.13	0.13	0.13	1.02	1.26
Working full time (at age 6)	0.38	0.30	0.38	17.84	1.25
Working part time (at age 6)	0.30	0.34	0.29	-8.51	1.36
Working hours (at age 6)	22.52	20.47	22.49	11.56	0.14
Time at firm (at age 6)	3.66	4.23	3.68	-11.06	-0.33
Size of firm (at age 6)	4.87	5.37	4.91	-12.66	-1.07
Age at childbirth	28.15	27.60	27.85	11.53	6.19
Age at childbirth (20-25)	0.27	0.26	0.28	0.59	-2.68
Age at childbirth (25-30)	0.38	0.44	0.38	-10.49	1.17
Age at childbirth (30-35)	0.27	0.21	0.26	14.34	1.55
Age at childbirth (35+)	0.07	0.08	0.06	-6.69	0.98
Years of schooling (at age 6)	12.60	12.06	12.55	20.38	1.65
University degree (at age 6)	0.33	0.22	0.32	25.22	3.43
No degree (at age 6)	0.13	0.15	0.13	-5.18	-0.08
Paternal characteristics					
Working (yes/no) (at age 17)	0.65	0.80	0.66	-33.57	-2.34
Years of schooling (at age 17)	11.75	12.02	11.82	-12.49	-3.60
Missing identifier	0.15	0.11	0.16	11.73	-2.78
Missing info on education	0.17	0.13	0.18	10.32	-3.26
Regional characteristics					
Rural-urban (at age 6)	0.23	0.32	0.22	-18.52	2.58
Region East Germany (at age 6)	0.47	0.35	0.46	24.57	0.62
Location in 1989	0.50	0.35	0.49	30.41	1.23
Maternal well-being					
Life satisfaction (at age 6)	6.57	7.04	6.55	-30.11	0.91
Time dummies					
Year 2001	0.17	0.08	0.14	26.40	6.53
Year 2002	0.13	0.12	0.13	4.28	1.09
Year 2003	0.08	0.12	0.09	-11.15	-2.52
Year 2004	0.07	0.13	0.07	-20.64	-2.13
Year 2005	0.10	0.13	0.10	-8.69	0.61
Year 2006	0.17	0.10	0.19	18.33	-4.84
Year 2007	0.12	0.09	0.12	9.16	0.11
Year 2008	0.07	0.08	0.07	-5.91	-0.47
Year 2009	0.05	0.08	0.05	-12.95	1.30
Year 2010	0.05	0.07	0.05	-8.95	-0.05

Note: Summary statistics of all conditioning variables for treated, unmatched and matched control individuals. The first two columns present the means of selected variables before treatment for treatment and control groups. The third column displays the standardised per cent bias before matching. It is the per cent difference of the sample means in the treatment and the matched control sample as a percentage of the square root of the average of the sample variances in both groups. The fourth column shows the standardised per cent bias after matching. Own calculations. Source: SOEP v27 (waves 2001-2010).

Table A.4: Estimation of propensity score in the sample of preschool children and of adolescents

	Propensity of job loss	
	Sample of preschool children	Sample of adolescents
Child & family characteristics		
Age of child (in months)	0.003 (0.0045)	
Gender (female=1)	-0.012 (0.0356)	0.039 (0.0288)
Migration background	-0.027 (0.0785)	0.020 (0.0788)
Log(HH income) (at birth/age 6)	-0.019 (0.0538)	-0.023* (0.0121)
Partnered (at birth/age 6)	-0.103 (0.0763)	-0.000 (0.0627)
Number of children in HH (at birth/age 6)	-0.006 (0.0274)	-0.014 (0.0190)
Maternal characteristics		
Working full time (prior birth)	-0.002 (0.0579)	
Working part time (prior birth)	0.048 (0.0539)	
Working full time (at birth/ at age 6)	0.041 (0.0499)	0.105 (0.0859)
Working part time (at birth/ at age 6)	0.027 (0.0522)	0.095 (0.0599)
Working hours (at age 6)		0.000 (0.0021)
Time at firm (at age 6)		-0.004 (0.0032)
Size of firm (at age 6)		-0.016** (0.0063)
Years schooling (at birth/ at age 6)	-0.011 (0.0087)	0.014 (0.0104)
University degree (at age 6)		0.013 (0.0537)
No degree (at age 6)		0.016 (0.0504)
Migration background	0.112 (0.0866)	0.010 (0.0855)
Age at childbirth		0.010 (0.0068)
Age at childbirth (20-25)	-0.006 (0.0806)	0.037 (0.0488)
Age at childbirth (25-30)	-0.025 (0.0451)	
Age at childbirth (30-35)		0.027 (0.0484)
Age at childbirth (35+)	-0.033 (0.0464)	-0.053 (0.0840)
Paternal characteristics		
Working (yes/no) (at age 6/ at age 17)	0.048 (0.1010)	-0.095* (0.0508)
Years schooling (at age 6/ at age 17)	0.008 (0.0086)	-0.012 (0.0075)
Missing identifier	0.078 (0.0805)	-0.005 (0.1121)
Missing info on education	0.009 (0.1113)	-0.055 (0.1083)
Regional characteristics		
Rural urban (prior birth/ at age 6)	0.015 (0.0399)	-0.048 (0.0324)
Location in 1989	0.014 (0.0741)	0.124 (0.0921)
Region East Germany (at birth/age 6)	0.025 (0.0747)	-0.119 (0.0918)
Maternal well-being		
Satisfied w/ being a mother around birth	0.075 (0.0496)	
Life satisfaction at 6		-0.016* (0.0094)
<i>N</i>	229	522
<i>R</i> ²	0.074	0.096

Note: This table depicts the linear probability model estimates of the propensity score. The first column presents the results for the sample of preschool children and includes a linear time trend; and column two comprises estimates for the adolescence sample also controlling for year fixed effects. Source: SOEP v27 (waves 2001-2010). Own calculations, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.5: Full regression models of Table 2 (Maternal involuntary maternal job loss and socio-emotional behaviour of preschool children)

	Socio-emotional behaviour				
	(1)	(2)	(3)	(4)	(5)
Involuntary job loss	0.510*	0.550*			0.565**
	(0.3042)	(0.3085)			(0.2256)
Plant closure			0.857	0.935	
			(0.6582)	(0.6516)	
Dismissal by employer			0.334	0.356	
			(0.2956)	(0.3053)	
Child & family characteristics					
Age of child (in months)	-0.012	-0.015	-0.012	-0.015	-0.034
	(0.0183)	(0.0180)	(0.0185)	(0.0183)	(0.0246)
Gender (female=1)	-0.254*	-0.238*	-0.245*	-0.228*	-0.712***
	(0.1323)	(0.1329)	(0.1355)	(0.1363)	(0.1946)
Migration background	0.139	0.192	0.132	0.186	0.526
	(0.3249)	(0.3214)	(0.3238)	(0.3202)	(0.3680)
Log(HH income) (at birth)	0.190	0.209	0.186	0.206	-0.457**
	(0.1969)	(0.1986)	(0.1948)	(0.1961)	(0.2131)
Partnered (at birth)	0.087	0.113	0.095	0.123	0.662**
	(0.2737)	(0.2819)	(0.2707)	(0.2778)	(0.3305)
Number of children (at birth)	-0.203**	-0.187**	-0.206**	-0.190**	-0.177
	(0.0925)	(0.0925)	(0.0938)	(0.0938)	(0.1681)
Maternal characteristics					
Migration background	-0.562*	-0.573*	-0.572*	-0.585*	-1.583***
	(0.3393)	(0.3369)	(0.3412)	(0.3387)	(0.3516)
Working full time (prior birth)	-0.315	-0.294	-0.325	-0.306	-0.065
	(0.2070)	(0.2030)	(0.2105)	(0.2066)	(0.3054)
Working part time (prior birth)	0.129	0.130	0.134	0.136	0.242
	(0.1930)	(0.1925)	(0.1925)	(0.1919)	(0.2635)
Working full time (at birth)	0.267	0.235	0.248	0.215	-0.100
	(0.1869)	(0.1812)	(0.1869)	(0.1811)	(0.3646)
Working part time (at birth)	-0.023	-0.029	-0.025	-0.031	-0.268
	(0.1683)	(0.1699)	(0.1684)	(0.1700)	(0.2579)
Years of education (at birth)	-0.051	-0.047	-0.050	-0.046	-0.050
	(0.0361)	(0.0361)	(0.0360)	(0.0360)	(0.0531)
Age at childbirth (20-25)	0.297	0.252	0.320	0.275	0.675**
	(0.2927)	(0.3129)	(0.2941)	(0.3137)	(0.3132)
Age at childbirth (25-30)	0.217	0.235	0.225	0.244	0.677***
	(0.1690)	(0.1669)	(0.1719)	(0.1697)	(0.2347)
Age at childbirth (35+)	0.239	0.253	0.226	0.239	1.071**
	(0.1915)	(0.1899)	(0.1878)	(0.1860)	(0.4820)
Paternal characteristics					
Working (yes/no) (at age 6)	0.084	0.119	0.071	0.103	0.649
	(0.3902)	(0.3660)	(0.3877)	(0.3621)	(0.5992)
Years of schooling (at age 6)	0.003	-0.000	0.005	0.002	0.027
	(0.0317)	(0.0321)	(0.0318)	(0.0322)	(0.0487)
Missing identifier	-0.225	-0.268	-0.214	-0.256	0.433
	(0.3413)	(0.3389)	(0.3393)	(0.3360)	(0.5366)
Missing info on education	0.442	0.455	0.440	0.451	0.593
	(0.4501)	(0.4288)	(0.4487)	(0.4261)	(0.6457)
Regional characteristics					
Rural-urban (prior birth)	-0.179	-0.283*	-0.176	-0.281*	-0.511**
	(0.1487)	(0.1667)	(0.1508)	(0.1686)	(0.2497)
Region East Germany (at birth)	0.362	0.127	0.354	0.111	0.205
	(0.3124)	(0.3190)	(0.3114)	(0.3179)	(0.3814)
Location in 1989	-0.411	-0.427	-0.411	-0.426	-0.559
	(0.3256)	(0.3252)	(0.3242)	(0.3233)	(0.4099)
Maternal well-being					
Satisfied w/ being mother (around birth)	0.315	0.308	0.324	0.319	0.112
	(0.2081)	(0.2060)	(0.2066)	(0.2040)	(0.2884)
Maternal employment post-job loss					
Regional unemployment rate (at age 6)		0.044*		0.045*	
		(0.0264)		(0.0263)	
Working (yes/no) (at age 6)		-0.094		-0.103	
		(0.2448)		(0.2456)	
Summary statistics					
N	229	229	229	229	226
R^2	0.146	0.160	0.150	0.164	0.439
Adjusted R^2	0.041	0.047	0.040	0.047	0.369

Note: This table depicts the same results as Table 2 (column 6, 7, 9, 10, and 11) including the estimates of all conditioning variables. Column 1 is similar to column 6 of Table 2 and includes all conditioning variables summarized in Table 1, i.e. controls for family/child characteristics, maternal, paternal, and regional characteristics as well as maternal well-being. The second column adds maternal working status after job loss at age 6 and regional unemployment rate to the model; and the third and fourth column depict the results obtained analysing plant closure and dismissal by employer separately using the same controls as column 1 and 2 of this table respectively. The last column shows all estimates from regression-adjusted matching using the same set of controls as column 1 of this table (or column 11 of Table 2). All models include a linear time trend. Own calculations. Source: SOEP v27 (waves 2008-2010). Robust standard errors in parentheses, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.6: Full regression models of Table 3 (Maternal involuntary maternal job loss and internal locus of control of adolescents)

	Internal locus of control				
	(1)	(2)	(3)	(4)	(5)
Involuntary job loss	-0.258*	-0.265*			-0.216*
Plant closure	(0.1407)	(0.1407)			(0.1247)
Dismissal by employer			-0.066 (0.1831)	-0.084 (0.1858)	
			-0.386** (0.1811)	-0.384** (0.1800)	
Child & family characteristics					
Gender (female=1)	0.123 (0.0877)	0.117 (0.0885)	0.118 (0.0873)	0.113 (0.0882)	0.077 (0.1450)
Migration background	0.140 (0.2067)	0.143 (0.2046)	0.154 (0.2089)	0.155 (0.2069)	0.314 (0.2431)
Partnered (at age 6)	-0.171 (0.2233)	-0.162 (0.2296)	-0.175 (0.2233)	-0.168 (0.2295)	-0.269 (0.3018)
Number of children in HH (at age 6)	0.029 (0.0561)	0.034 (0.0555)	0.030 (0.0556)	0.035 (0.0552)	0.053 (0.0819)
Log(HH income) (at age 6)	0.056 (0.0370)	0.056 (0.0369)	0.054 (0.0369)	0.055 (0.0369)	-0.008 (0.0503)
Maternal characteristics					
Migration background	-0.072 (0.2327)	-0.101 (0.2332)	-0.080 (0.2344)	-0.107 (0.2350)	-0.455 (0.2819)
Working full time (at age 6)	0.402 (0.2806)	0.408 (0.2828)	0.406 (0.2792)	0.411 (0.2816)	0.696 (0.4600)
Working part time (at age 6)	0.328* (0.1975)	0.334* (0.1994)	0.334* (0.1975)	0.339* (0.1994)	0.666** (0.3078)
Working hours (at age 6)	-0.005 (0.0068)	-0.005 (0.0068)	-0.006 (0.0067)	-0.005 (0.0067)	-0.011 (0.0119)
Time at firm (at age 6)	0.020** (0.0092)	0.021** (0.0095)	0.019** (0.0093)	0.020** (0.0096)	0.035** (0.0155)
Size of firm (at age 6)	-0.012 (0.0218)	-0.011 (0.0217)	-0.013 (0.0217)	-0.011 (0.0216)	-0.026 (0.0294)
Years of education (at age 6)	-0.031 (0.0300)	-0.028 (0.0301)	-0.029 (0.0298)	-0.027 (0.0300)	-0.077 (0.0509)
University degree (at age 6)	0.126 (0.1437)	0.129 (0.1432)	0.122 (0.1421)	0.125 (0.1418)	0.286 (0.2312)
No degree (at age 6)	-0.158 (0.1542)	-0.149 (0.1555)	-0.168 (0.1541)	-0.158 (0.1555)	-0.270 (0.2269)
Age at childbirth	-0.001 (0.0171)	-0.004 (0.0179)	-0.002 (0.0172)	-0.004 (0.0180)	0.005 (0.0209)
Age at childbirth (20-25)	-0.093 (0.1359)	-0.096 (0.1369)	-0.094 (0.1361)	-0.097 (0.1370)	-0.128 (0.1636)
Age at childbirth (30-35)	0.001 (0.1352)	-0.001 (0.1361)	-0.002 (0.1359)	-0.004 (0.1367)	-0.156 (0.1788)
Age at childbirth (35+)	-0.187 (0.2195)	-0.172 (0.2210)	-0.181 (0.2214)	-0.167 (0.2226)	-0.620* (0.3570)
Paternal characteristics					
Working (yes/no) (at age 17)	0.133 (0.1500)	0.141 (0.1511)	0.139 (0.1496)	0.147 (0.1508)	0.240 (0.2058)
Years of schooling (at age 17)	-0.017 (0.0231)	-0.017 (0.0233)	-0.017 (0.0230)	-0.017 (0.0232)	-0.016 (0.0407)
Missing identifier	-0.010 (0.2817)	0.030 (0.2735)	-0.033 (0.2862)	0.006 (0.2789)	-0.532 (0.3728)
Missing info on education	0.041 (0.2605)	-0.002 (0.2536)	0.059 (0.2641)	0.017 (0.2581)	0.680 (0.4275)
Regional characteristics					
Rural-urban (at age 6)	0.133 (0.0930)	0.149 (0.0967)	0.131 (0.0933)	0.148 (0.0969)	0.173 (0.1617)
Region East Germany (at age 6)	-0.177 (0.2736)	-0.101 (0.3006)	-0.180 (0.2752)	-0.104 (0.3021)	-0.537 (0.3677)
Location in 1989	0.443 (0.2890)	0.445 (0.2884)	0.441 (0.2911)	0.443 (0.2901)	0.518 (0.3583)
Maternal well-being					
Life satisfaction (at age 6)	-0.025 (0.0281)	-0.024 (0.0280)	-0.026 (0.0283)	-0.024 (0.0282)	-0.061 (0.0420)
Maternal employment post-job loss					
Regional unemployment rate		-0.008 (0.0156)		-0.008 (0.0156)	
Working (at age 17)		-0.167 (0.1519)		-0.153 (0.1527)	
Year fixed effects	Yes	Yes	Yes	Yes	Yes
N	522	522	522	522	521
R ²	0.152	0.154	0.155	0.157	0.283
Adjusted R ²	0.089	0.088	0.090	0.089	0.229

Note: This table depicts the same results as Table 3 (column 6, 7, 9, 10, and 11) including the estimates of all conditioning variables. Column 1 is similar to column 6 of Table 3 and includes all conditioning variables summarized in Table 1, i.e. controls for family/child characteristics, maternal, paternal, and regional characteristics as well as maternal well-being. The second column adds maternal working status after job loss at age 6 and regional unemployment rate to the model; and the third and fourth column depict the results obtained analysing plant closure and dismissal by employer separately using the same controls as column 1 and 2 of this table respectively. The last column shows all estimates from regression-adjusted matching using the same set of controls as column 1 of this table (or column 11 of Table 3). All models include year fixed effects. Own calculations. Source: SOEP v27 (waves 2001-2010). Robust standard errors in parentheses, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.7: Estimation of other child outcomes and involuntary maternal job loss (regression-adjusted propensity score matching)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Open- ness	Conscient- iousness	Extra- version	Agreeable- ness	Neuroticism	German grade	Math grade	Grade repetition
Panel A : Sample of preschool children								
Involuntary job loss	0.122 (0.1457)	0.091 (0.1846)	-0.032 (0.1755)	-0.179 (0.2458)	0.604*** (0.1291)			
<i>N</i>	225	226	226	226	226			
<i>R</i> ²	0.336	0.356	0.361	0.386	0.463			
Adjusted <i>R</i> ²	0.253	0.275	0.282	0.309	0.396			
Panel B: Sample of adolescents								
Involuntary job loss	-0.227 (0.1931)	-0.165 (0.1769)	-0.170 (0.1872)	-0.208 (0.1765)	-0.049 (0.1769)	0.156* (0.0874)	0.119 (0.1266)	0.110** (0.0513)
<i>N</i>	223	223	223	223	223	517	517	521
<i>R</i> ²	0.361	0.429	0.200	0.336	0.267	0.287	0.216	0.287
Adjusted <i>R</i> ²	0.257	0.337	0.071	0.229	0.148	0.234	0.157	0.234

Note: Each cell depicts the effect of maternal job loss on other child outcomes, namely personality traits in the preschool and adolescence sample; and grades and grade repetition only for the sample of adolescents. Panel A contains estimations on personality traits for preschool children and Panel B depicts estimates of involuntary job loss on personality traits and "cognitive ability" for adolescents. All models in the sample of preschool children include a linear time trend and the preferred set of conditioning variables as column 6 of Table 2, and in the sample of adolescents all models comprise year fixed effects and all controls of column 6 of Table 3. Own calculations. Source: SOEP v27 (waves 2001-2010). Robust standard errors in parentheses, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.8: Estimation of maternal outcomes and involuntary maternal job loss (regression-adjusted propensity score matching)

	(1)	(2)	(3)	(4)
	Life satisfaction	Household income	Neuroticism	Internal locus of control
Panel A: Sample of preschool children				
Involuntary job loss	-0.975*** (0.2575)	-0.045 (0.0563)	0.556*** (0.2039)	
<i>N</i>	225	226	225	
<i>R</i> ²	0.553	0.830	0.319	
Adjusted <i>R</i> ²	0.495	0.808	0.233	
Panel B: Sample of adolescents				
Involuntary job loss	-0.044 (0.1855)	-0.120*** (0.0453)	-0.006 (0.1232)	0.108 (0.1388)
<i>N</i>	521	520	521	515
<i>R</i> ²	0.427	0.545	0.194	0.241
Adjusted <i>R</i> ²	0.385	0.511	0.134	0.184

Note: Each cell depicts the effect of maternal job loss on maternal outcomes. Maternal outcomes include overall life satisfaction, household income, and the personality dimension neuroticism in both samples. In the sample of adolescents internal locus of control is also assessed as maternal outcome post-job loss. Panel A contains estimations on maternal outcomes in the sample of preschool children and Panel B depicts estimates of involuntary job loss on maternal outcomes in the sample of adolescents. All models in the sample of preschool children include a linear time trend and the preferred set of conditioning variables as column 6 of Table 2, and in the sample of adolescents all models comprise year fixed effects and all controls of column 6 of Table 3. Own calculations. Source: SOEP v27 (waves 2001-2010). Robust standard errors in parentheses, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

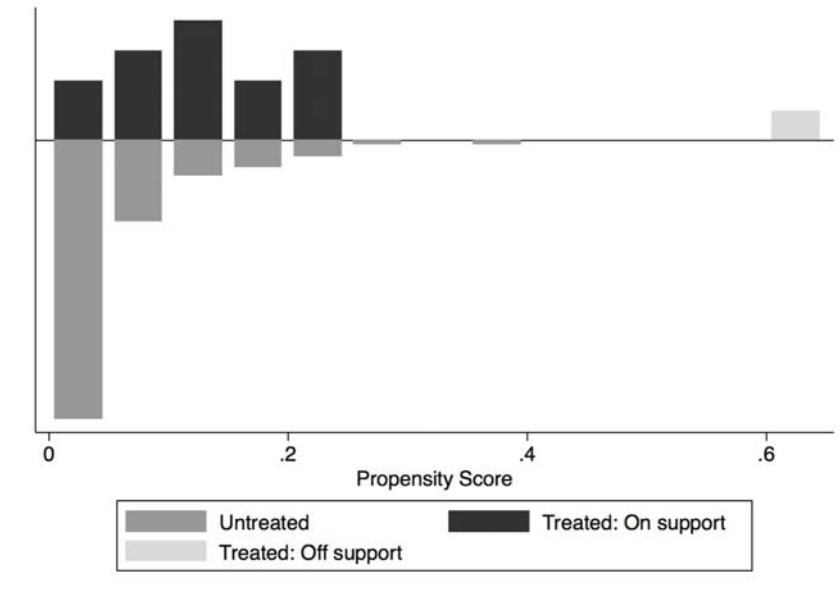
Table A.9: Estimation of adolescents' internal locus of control including maternal outcomes after involuntary job loss – splitting types of job loss (OLS)

	Internal locus of control			
	(1)	(2)	(3)	(4)
Plant closure	-0.060 (0.1817)	-0.070 (0.1861)	-0.069 (0.1861)	-0.120 (0.1820)
Dismissal by employer	-0.390** (0.1811)	-0.386** (0.1860)	-0.386** (0.1864)	-0.379** (0.1868)
Life satisfaction (post)	Yes	Yes	Yes	Yes
HH income (post)	No	Yes	Yes	Yes
Neuroticism (post)	No	No	Yes	Yes
Internal locus of control (post)	No	No	No	Yes
<i>N</i>	522	521	521	515
<i>R</i> ²	0.157	0.156	0.156	0.174
Adjusted <i>R</i> ²	0.090	0.087	0.086	0.102

Note: Each cell depicts the effect of maternal job loss on the internal locus of control for adolescents splitting involuntary job loss in plant closure and dismissal by employer. The first column includes maternal overall life satisfaction after job loss in the regression. The second column adds household income after job loss and the third column includes maternal personality dimension neuroticism. The last column of this table adds maternal internal locus of control as additional control variable. All models comprise year fixed effects and all controls of the preferred model (column 6, Table 3). Own calculations. Source: SOEP v27 (waves 2001-2010). Robust standard errors in parentheses, significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

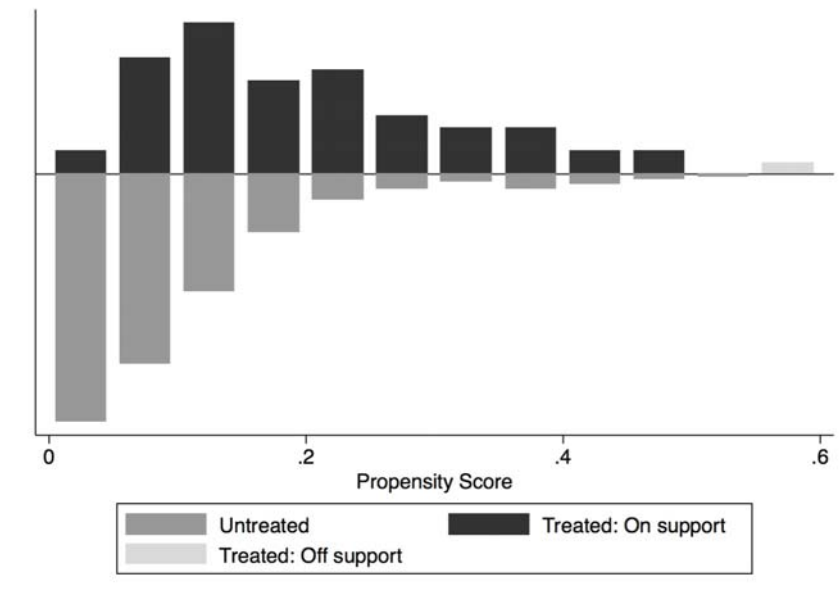
Figures

Figure A.1: Histogram of propensity scores of treatment and control groups (sample of preschool children)



Source: SOEP v27 (waves 2008-2010), own calculations.

Figure A.2: Histogram of propensity scores of treatment and control groups (sample of adolescents)



Source: SOEP v27 (waves 2001-2010), own calculations.